I. C. 6305 JUNE, 1930

DEPARTMENT OF COMMERCE

UNITED STATES BUREAU OF MINES
SCOTT TURNER, DIRECTOR

INFORMATION CIRCULAR

SURVEY OF CRACKING PLANTS
JANUARY 1, 1930

BY

G. R. HOPKINS

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Introduction

The last ten years have witnessed a rapid increase in the importance of cracking as a means of producing gasoline. The first survey of cracking equipment made by this bureau, as of June 1, 1925, showed a total charging capacity of 832,692 barrels as compared with 1,708,940 barrels less than five years later, a gain of 105 per cent. Over this same period the increase in the capacity of refineries to process crude oil has amounted to only about 33 per cent. In common with practically all industrial equipment, the average size of a cracking unit has increased steadily in recent years. There are fewer cracking units to-day than there were five years ago, but the average size has grown from approximately 300 barrels to about 850 barrels at present. Until the last five years a 1,000-barrel unit was considered large, but to-day 10,000-barrel units are quite common.

An interesting and important development that has occurred in cracking practice in recent years concerns the increase in "on-stream" time - in other words, the decrease in time that the units are shut-down for repairs and for the removal of coke and sediment. Thus the modern units often run several months continuously before a shut-down becomes necessary. This has tended to increase the total capacity of our cracking plants so that the gain in potential ability to produce gasoline over the past five years exceeds the very appreciable figure of 105 per cent given above.

Trends in the establishment of cracking plants

According to reports received there were 2,002 cracking units completed or being built as of January 1, 1930, with a total daily charging capacity of 1,708,940 barrels. Compared with a year ago this indicates a decrease of 9 per cent in the number of units, but an increase of 16 per cent in total capacity.

Of the total capacity of 1,708,940 barrels for the completed plants and those under construction, 1,419,200 barrels, or 83 per cent, represents the capacity of the operating plants. This compares with a total operating capacity of 1,194,501 barrels on January 1, 1929, which comprised 81 per cent of the total on that date. There is a tendency to dismantle cracking equipment as soon as it becomes obsolete; in other words, the operators scrap such equipment rather than

1/ The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgement is used: "Reprinted from U. S. Bureau of Mines Information Circular 6305."

2/ Associate economic analyst, U. S. Bureau of Mines.

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retain it as inoperative in the hope that economic conditions conducive of a profi will return. Thus the total capacity of the shut-down plants has fallen from 253,000 barrels on January 1, 1928, to 139,840 barrels two years later.

That the total capacity of the cracking equipment will show a material growth during 1930 is forecast by the amount of construction work under way on January 1, 1930. The total capacity of the units being built on that date amounted to 149,900 barrels, as compared with 22,000 and 134,450 barrels on January 1, 1928 and 1929, respectively.

The greatest concentration of cracking equipment on January 1, 1930, was in the Texas Gulf Coast. This area with but 16 refineries had a total cracking capacity, completed and in process of construction, of 359,800 barrels. This was equivalent to 21 per cent of the total for the country and nearly double the cracking capacity in California, the next most important area. Practically all of the States showed a gain in cracking capacity in the 1930 census, but there were a few like New Jersey, that showed a decline. The total cracking capacity in New Jersey fell from 101,100, on January 1, 1929, to 90,400 barrels on January 1, 1930; this resulted principally from the dismantling of a number of Burton units during 1929.

The production of gasoline by means of the cracking process during 1929 amounted to 143,759,000 barrels, as compared with 122,554,000 barrels in 1928, a gain of 17 per cent. The price of gasoline is the chief factor governing the use of cracking equipment. The improvement in gasoline prices in the last half of 1928 stimulated cracking; likewise, the decline in prices in the early part of 1929 had a depressing effect. Cracking activity increased steadily during the last half of 1929, and during December, 1929, the proportion of cracked gasoline to the total output reached a new high level of 36.7 per cent.

The Texas district was the leader from the standpoint of quantity of gasoline made by cracking in 1929, but the East Coast district led in percentage; that is, in the proportion of cracked gasoline to total output. The use of the cracking process in California is growing steadily and, during 1929, 13 per cent of the total gasoline output of that State was produced by cracking as compared with 11 per cent in 1928.

Thirty-eight different types of cracking processes are listed in this survey as compared with 36 a year ago. Of the 38 types on January 1, 1930, 24 were used by one refining company only, and but few of the remaining 14 were being actually licensed. There appears to be a tendency toward the development of "modified" cracking processes and the appearance in this survey of such types as "Continuous high pressure," "Pipe still," and "Pressure coke," may be the result of such a trend. There is also a trend toward the development of combined cracking and skimming stills, and the absence from this survey of certain units of recent design is due largely to the fact that the refining companies preferred to consider them under the heading of skimming equipment.

The various processes which crack in the vapor phase, as contrasted with the more common method of cracking in the liquid phase, are said to be able to produce gasoline of relatively high anti-knock properties. The demand of the motorist for gasoline of high anti-knock qualities was as pronounced as ever in 192

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This would appear to be substantiated by the fact that the total capacity of the vapor phase units reported on January 1, 1930, amounted to 30,650 barrels, as compared with 17,000 barrels the previous year.

Developments in the operation of cracking plants

An interesting development in modern refinery practice is the growth in utilization of refinery gases, the major portion of which are produced in the process of cracking. These gases possess a high thermal value (1,200-1,800 B.t.u. per cubic foot) and are being utilized more and more as fuel under boilers and stills at refineries. These gases also comprise suitable raw material for the production of chemicals which are useful as solvents, in the manufacture of dyes, and as refrigerants. Gas formed by cracking is also being used to enrich water or producer gas. The production of still gases in a cracking unit varies with the cracking stock and with the temperatures and pressures used. The formation of a large amount of still gases during cracking was once regarded as distinctly undesirable, and cracking operations were so regulated as to keep their formation at a minimum. However, now that ways of utilizing these gases have been developed, the necessity of curtailing their output is not as urgent; in fact, there are some cracking plants now operating that produce but three products - gasoline, (pressure distillate) coke, and gas. Those refineries which utilize gases from their cracking stills instead of allowing them to escape into the air usually show a gain on their operations; that is, the total volume of the products obtained exceeds the volume of the crude or other oils charged. It should be pointed out, however, that the major portion of the "gains" shown by cracking plants results from the basic nature of the cracking process in converting a heavy oil; for example, fuel oil is converted into a light oil like gasoline of lower specific gravity but of greater volume.

The operation of cracking requires an excessive amount of heat and it is not surprising that large amounts are wasted. The tendency in the last few years, however, has been to utilize this waste heat to skim the crude, the topped crude thus obtained being charged directly to the cracking units. There has been a steady improvement in the design of cracked coils, particularly as regards the uniformity of heat distribution, and a considerably smaller number of B.t.u. per barrel of charging stock are now required than was the case five years ago.

Until the last few years, it was necessary with most cracking processes to shut down every few days to remove the coke deposited in the furnace and in the reaction chamber. This inconvenience has been largely eliminated in two ways, first, by regulating the velocity and temperature in the furnace so that coke can not form on the coils, and, secondly, by increasing the size and number of reaction chambers. Increasing the size of the reaction chamber allows more coke to form or a longer time to elapse between shut-downs; increasing the number of reaction chambers allows one or more to be in use, while the others are being cleaned out. One of the common types of cracking processes is reported to operate continuously for over two months between shut-downs and possible there are others that could surpass this record. Thus the increase in the total capacity of our cracking units over the past five years may be greater than is at first apparent because the shut-down of off-stream time has been materially reduced.

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There are two methods of operating cracking plants, namely, the residual method and the other, which, for the want of a better term, will be called the "cracking-to-coke" method. In the former the cracking operation is carried just far enough to yield a maximum of gasoline, leaving residual fuel oil and but little coke. The latter method with recycling yields but three products; gasoline, coke and gas. The question as to which method should be used depends upon the prices for gasoline and fuel oil and also upon the disposition that could be made of coke and gas.

Pipe stills are now being made which can be used either for skimming or cracking and it is becoming increasingly difficult to differentiate between straight distillation equipment and cracking stills. At one time it was a simple matter to segregate at a glance the cracking units from the skimming equipment. The line of demarcation was also clearly defined by the raw materials used - crude in the skimming plant and gas oil or fuel oil in the cracking plant. The modern cracking units can operate on any grade of oil between kerosene and heavy residuum, and the number of cases in which crude is being cracked with no previous preparation is steadily increasing.

Cracking plants have increased in flexibility - that is, are more susceptible to control as regards the products made. Thus, if the demand for gasoline warrants, the cracking operation can be operated to yield a maximum of gasoline with practically no other liquid products. Likewise, the yields of low cold test fuel oils, diesel oil, and distillate oils suitable for domestic heaters, can be increased materially if it should become necessary.

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RECAPITULATION BY YEARS

Year	Total units	Charging capacity, barrels per day			
		Operating	Shut down	Building	Total
June 1, 1925	2,527	690,492	26,200	116,000	832,692
June 1, 1926	2,559	844,800	47,690	47,600	940,090
Jan. 1, 1928	2,334	1,013,000	253,000	22,000	1,288,000
Jan. 1, 1929	2,205	1,194,501	147,923	134,450	1,476,874
Jan. 1, 1930	2,002	1,419,200	139,840	149,900	1,708,940

RECAPITULATION BY DISTRICTS

District	Total units	Charging capacity, barrels per day			
		Operating	Shut down	Building	Total
East coast	161	240,900	10,500	26,000	277,400
Appalachian	67	44,180	4,200	1,700	50,080
Ind., Ill., Ky., etc.	452	249,045	33,730	24,500	307,275
Okla., Kans., Mo.	392	192,050	30,050	11,500	233,600
Texas	351	369,370	6,800	64,200	440,370
Louisiana & Ark.	77	106,900	5,250	- - -	112,150
Rocky Mountain	423	51,255	45,310	3,000	99,565
California	79	165,500	4,000	19,000	188,500
Total	2,002	1,419,200	139,840	149,900	1,708,940
Texas Gulf Coast	19	305,000	52,500	2,300	359,800
La. Gulf Coast	5	77,000	- - -	- - -	77,000

RECAPITULATION BY STATES

State	Total units	Charging capacity, barrels per day			
		Operating	Shut down	Building	Total
Arkansas	25	9,500	4,250	- - -	13,750
California	79	165,500	4,000	19,000	188,500
Colorado	9	2,500	- - -	- - -	2,500
Georgia	2	3,600	- - -	- - -	3,600
Illinois	115	73,300	9,000	13,000	95,300
Indiana	246	132,100	17,100	9,000	158,200
Iowa	1	1,000	- - -	- - -	1,000
Kansas	103	66,000	7,250	- - -	73,250
Kentucky	36	10,600	1,600	2,500	14,700
Louisiana	52	97,400	1,000	- - -	98,400
Maryland	22	22,000	3,000	6,000	31,000
Massachusetts	17	31,300	- - -	- - -	31,300
Michigan	2	3,600	- - -	- - -	3,600
Missouri	85	16,000	7,400	- - -	23,400
Montana	2	- - -	500	1,500	2,000
New Jersey	47	76,900	1,500	12,000	90,400
New York	11	11,800	- - -	- - -	11,800
Ohio	63	43,795	6,030	700	50,525
Oklahoma	203	109,050	15,400	11,500	135,950
Pennsylvania	99	104,830	4,200	9,000	118,030
Rhode Island	3	6,000	- - -	- - -	6,000
South Carolina	8	7,500	6,000	- - -	13,500
Texas	351	369,370	6,800	64,200	440,370
Utah	32	6,400	3,800	- - -	10,200
West Virginia	9	6,800	- - -	- - -	6,800
Wyoming	380	42,355	41,010	1,500	84,865
Total	2,002	1,419,200	139,840	149,900	1,708,940

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RECAPITULATION BY TYPE OF PROCESS

Type of process	January 1, 1930		January 1, 1929	
	Total units	Total capacity, barrels per day	Total units	Total capacity, barrels per day
Black	12	16,000	12	12,000
Bruin	24	5,680	25	5,667
Buerger	93	103,700	89	55,600
Burton	895	171,440	1,060	192,586
Carborundum	1	3,000	1	3,000
Coast	80	14,000	80	14,000
Continuous high pressure	2	5,300	(1/)	(1/)
Converter	1	1,500	1	3,000
Cross	163	273,670	160	232,250
De Florez	1	1,200	1	1,000
Doherty	16	20,200	11	12,200
Donnelly	2	3,000	2	1,500
Dubbs	188	238,500	186	214,600
Fleming	8	2,700	21	6,000
Gyro	13	9,200	11	8,200
Holmes-Manley	129	240,800	154	232,107
Isom	100	100,000	100	100,000
Jenkins	49	75,000	47	58,850
Koontz	4	4,500	4	4,500
Leemon	5	2,250	5	2,500
Lewis	4	6,200	38	14,000
Lientz	1	6,000	1	2,500
Link	20	50,000	20	53,000
Ormont	4	1,000	4	1,000
Pipe still	4	8,450	(1/)	(1/)
Pratt	1	500	(1/)	(1/)
Pressure coke	13	19,500	(1/)	(1/)
Richie	1	600	1	600
Richmond	2	6,000	(1/)	(1/)
Setzler	1	1,600	1	1,600
Slagter	24	3,600	24	3,600
Sun Oil Co.	6	24,000	3	16,000
True Vapor Phase	2	10,500	(1/)	(1/)
Trumble	1	750	2	1,000
Tube and Tank	123	260,100	124	210,314
Vapor Phase	3	6,000	(1/)	(1/)
White Eagle	1	2,000	(1/)	(1/)
Winkler-Koch	5	10,500	2	2,600
Other	- -	- - -	15	11,100
Total	2,002	1,708,940	2,205	1,476,874

1/ Not listed prior to January 1, 1930.

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SURVEY OF CRACKING PLANTS, JANUARY 1, 1930

Status:	Company	Location	Number of Units	Total daily charging capacity, barrels	Type of process
	ARKANSAS				
SD.	Houston Oil Co. of Texas	Camden	2	2,000	Dubbs
Op.	Kettle Creek Refg. Co.	El Dorado	2	1,800	Dubbs
Op.	Lion Oil Refg. Co.	El Dorado	10	3,000	Burton
SD.	Lion Oil Refg. Co.	El Dorado	5	1,500	Burton
Op.	Lion Oil Refg. Co.	El Dorado	1	1,200	Pipe still
SD.	Ouachita Valley Refg. Co.	El Dorado	1	750	Dubbs
Op.	Root Refg. Co.	El Dorado	2	1,500	Dubbs
Op.	Simms Oil Co.	Smackover	2	2,000	Cross
			25	13,750	
	CALIFORNIA 1/				
SD.	General Pet. Corp. of Calif.	Los Angeles	2	3,000	Vapor Phase
Op.	Hercules Gasoline Co.	Los Angeles	1	2,000	Jenkins
Op.	Richfield Oil Co. of Calif.	Hynes	4	14,000	Cross
Op.	Richfield Oil Co. of Calif.	Watson	12	16,000	Black
Op.	Rio Grande Oil Co.	Vinvale	2	2,000	Jenkins
Op.	Shell Oil Co.	Dominguez	8	32,000	Dubbs
Op.	Shell Oil Co.	Martinez	1	1,500	Converter
Op.	Shell Oil Co.	Martinez	8	10,000	Dubbs
Op.	Shell Oil Co.	Watson	8	8,000	Dubbs
Op.	Standard Oil Co. of Calif.	El Segundo	8	20,000	Dubbs
Bldg.	Standard Oil Co. of Calif.	El Segundo	4	12,000	Dubbs
Op.	Standard Oil Co. of Calif.	Richmond	8	20,000	Dubbs
Bldg.	The Texas Co. (Calif.)	Fillmore	1	4,000	Cross
Bldg.	The Texas Co. (Calif.)	Watson	1	3,000	Holmes-Manley
Op.	The Texas Co. (Calif.)	Watson	2	4,000	Holmes-Manley
Op.	Union Oil Co. of Calif.	Wilmington	1	3,000	Carborundum
SD.	Union Oil Co. of Calif.	Wilmington	1	1,000	Cross

1/ Data compiled by E. T. Knudsen, San Francisco Office of the U. S. Bureau of Mines.

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Status:	Company	Location	Number of Units	Total daily charging capacity, barrels	Type of process
	CALIFORNIA (Continued)				
Op.	Union Oil Co. of Calif.	Wilmington	6	27,000	Cross
Op.	Union Oil Co. of Calif.	Wilmington	1	6,000	Lientz
			79	188,500	
	COLORADO				
Op.	Continental Oil Co.	Florence	8	1,500	Burton
Op.	The Texas Co.	Craig	1	1,000	Holmes-Manley
			9	2,500	
	GEORGIA				
Op.	The Atlantic Refg. Co.	Brunswick	2	3,600	Lewis
			2	3,600	
	ILLINOIS				
Op.	Indian Refg. Co.	Lawrenceville	8	8,000	Cross
Op.	Indian Refg. Co.	Lawrenceville	4	2,000	Dubbs
Op.	Lincoln Oil Refg. Co.	Robinson	4	9,600	Holmes-Manley
Op.	Lubrite Refg. Co.	E. St. Louis	4	1,200	Fleming
Op.	Lubrite Refg. Co.	E. St. Louis	1	500	Pratt
Op.	Shell Pet. Corp.	Wood River	2	6,000	Cross
Bldg.	Shell Pet. Corp.	Wood River	1	10,000	True Vapor Phase
Op.	Shell Pet. Corp.	Wood River	14	14,500	Dubbs
Op.	Standard Oil Co.(Ind.)	Wood River	20	6,500	Burton
SD.	Standard Oil Co.(Ind.)	Wood River	40	9,000	Burton
Op.	Standard Oil Co.(Ind.)	Wood River	6	13,000	Holmes-Manley
Op.	The Texas Co.	Lockport	6	9,000	Holmes-Manley
Bldg.	The Texas Co.	Lockport	2	3,000	Pressure Coke
Op.	White Star Refg. Co.	Wood River	3	3,000	Dubbs
			115	95,300	
	INDIANA				
Op.	Bartles-Magure Oil Co.	E. Chicago	2	4,000	Jenkins
Bldg.	Empire Oil & Refg. Co.	E. Chicago	6	9,000	Doherty
Op.	Shell Pet. Corp.	E. Chicago	8	10,000	Dubbs
Op.	Sinclair Refg. Co.	E. Chicago	40	40,000	Isom
Op.	Standard Oil Co.(Ind.)	Whiting	60	12,800	Burton
SD.	Standard Oil Co.(Ind.)	Whiting	106	17,100	Burton
Op.	Standard Oil Co.(Ind.)	Whiting	2	5,300	Continuous High Pressure
Op.	Standard Oil Co.(Ind.)	Whiting	22	60,000	Holmes-Manley
			246	158,200	

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Status:	Company	Location	Number of Units	Total daily charging capacity, barrels	Type of process
	ICWA				
Op.	Mona Motor Oil Co.	E. Omaha	1	1,000	Cross
			1	1,000	
	KANSAS				
Op.	Barnsdall Refineries, Inc.	Wichita	4	1,500	Dubbs
Op.	Derby Oil & Refg. Corp.	Wichita	4	2,200	Dubbs
Op.	Golden Rule Refg. Co.	Wichita	1	1,200	Jenkins
SD.	Hutchinson Oil Refg. Co.	Hutchinson	1	750	Trumble
Op.	Independent Oil & Gas Co.	Kansas City	1	2,200	Dubbs
Op.	Kanotex Refg. Co.	Arkansas City	3	3,600	Jenkins
Op.	Kanotex Refg. Co.	Arkansas City	1	2,000	Winkler-Koch
SD.	Miller Pet. Co.	Humboldt	1	500	Cross
Op.	National Refg. Co.	Coffeyville	1	1,600	Setzler
Op.	The Peerless Oil & Refg. Co.	Chanute	2	3,000	Jenkins
Op.	Shell Pet. Corp.	Arkansas City	8	9,000	Dubbs
Op.	Sinclair Refg. Co.	Argentine	10	10,000	Isom
Op.	Sinclair Refg. Co.	Coffeyville	10	10,000	Isom
Op.	Skelly Oil Co.	Eldorado	6	6,000	Jenkins
SD.	Skelly Oil Co.	Eldorado	6	6,000	Jenkins
Op.	Skelly Oil Co.	Eldorado	1	3,500	Pipe Still
Op.	Standard Oil Co.(Kans.)	Neodesha	20	1,200	Burton
Op.	Standard Oil Co.(Kans.)	Neodesha	1	2,500	Holmes-Manley
Op.	Vickers Pet. Co.	Potwin	2	1,500	Dubbs
Op.	White Eagle Oil Corp.	Augusta	20	5,000	Burton
			103	73,250	
	KENTUCKY				
Op.	Aetna Oil Service, Inc.	Louisville	1	400	Fleming
Op.	Ashland Refg. Co., Inc.	Leach	1	1,000	Dubbs
Bldg.	Latonia Refg. Corp.	Latonia	1	2,500	Tube and Tank
SD.	Louisville Refg. Co., Inc.	Louisville	2	1,600	Dubbs
Op.	Standard Oil Co.(Ky.)	Louisville	30	7,200	Burton
Op.	The Texas Co.	Pryse	1	2,000	Holmes-Manley
			36	14,700	
	LOUISIANA				
Op.	Chalmette Pet. Corp.	Chalmette	1	2,000	Winkler-Koch

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Status:	Company	Location	Number of Units	Total daily charging capacity, barrels	Type of process
	LOUISIANA (Cont'd)				
Op.	Corco (Crystal) Oil Refg. Corp.	Cedar Grove	2	3,400	Jenkins
Op.	Dixie Oil Co., Inc.	Superior	1	2,500	Cross
Op.	Louisiana Oil Refg. Corp.	Bossier City	9	12,500	Tube & Tank
Op.	Shell Pet. Corp.	Sellers	6	10,000	Dubbs
Op.	Shreveport-Eldorado P.L.Co., Inc.	Shreveport	2	2,000	Dubbs
SD.	Shreveport-Eldorado P.L.Co., Inc.	Shreveport	1	1,000	Jenkins
Op.	Standard Oil Co.of La.	Baton Rouge	2	5,000	Cross
Op.	Standard Oil Co.of La.	Baton Rouge	20	50,000	Link
Op.	Standard Oil Co.of La.	Baton Rouge	8	10,000	Tube & Tank
			52	98,400	
	MARYLAND				
Op.	Continental Oil Co.	Baltimore	2	4,000	Cross
Op.	Continental Oil Co.	Baltimore	4	2,000	Dubbs
SD.	Interocean Oil Co. of Del.	Baltimore	2	1,000	Dubbs
SD.	Interocean Oil Co. of Del.	Baltimore	4	2,000	Leamon
Op.	Standard Oil Co. of N.J.	Baltimore	8	16,000	Tube & Tank
Bldg.	Standard Oil Co. of N.J.	Baltimore	2	6,000	Tube & Tank
			22	31,000	
	MASSACHUSETTS				
Op.	Beacon Oil Co., Inc.	Everett	13	25,000	Tube & Tank
Op.	Braintree Oil Processing Co.	E. Braintree	2	4,500	Doherty
Op.	Braintree Oil Processing Co.	E. Braintree	2	1,800	Holmes-Manley
			17	31,300	
	MICHIGAN				
Op.	White Star Refg. Co.	Trenton	2	3,600	Dubbs
			2	3,600	

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Status:	Company	Location	Number of Units	Total daily charging capacity, barrels	Type of process
	MISSOURI				
Op.	Standard Oil Co.(Ind.)	Sugar Creek	20	7,000	Burton
SD.	Standard Oil Co.(Ind.)	Sugar Creek	60	7,400	Burton
Op.	Standard Oil Co.(Ind.)	Sugar Creek	4	8,000	Holmes-Manley
Op.	Wilhoit Refg. Co.	Joplin	1	1,000	Jenkins
			85	23,400	
	MONTANA				
SD.	Arro Oil & Refg. Co.	W. Lewistown	1	500	Dubbs
Bldg.	Laurel Oil & Refg. Co.	Laurel	1	1,500	Donnelly
			2	2,000	
	NEW JERSEY				
Op.	The Bertrin Pet. Co.	Maurer	1	3,000	Cross
Op.	Eastern Oil Processing Co.	Petty Island	2	1,700	Doherty
Op.	Gulf Refg. Co.	Bayonne	1	1,200	de Florez
Op.	Standard Oil Co. of N.J.	Bayonne, etc.	27	55,500	Tube and Tank
Bldg.	Standard Oil Co. of N.J.	Bayonne, etc.	4	12,000	Tube and Tank
Op.	Tide Water Oil Co.	Bayonne	4	9,000	Tube and Tank
Op.	Vacuum Oil Co.	Paulsboro	3	3,500	Cross
Op.	Vacuum Oil Co.	Paulsboro	3	3,000	Tube and Tank
SD.	Warner-Quinlan Co.	Warners	2	1,500	Dubbs
			47	90,400	
	NEW YORK				
Op.	Standard Oil Co. of N. Y.	Brooklyn and L.I. City	6	8,000	Cross
Op.	Standard Oil Co. of N.Y.	Buffalo	2	2,000	Cross
Op.	Vacuum Oil Co.	Olean	2	1,200	Cross
Op.	Vacuum Oil Co.	Olean	1	600	Tube and Tank
			11	11,800	
	OHIO				
Bldg.	Allegheny-Arrow Oil Co.	Canton	1	700	Dubbs
Op.	Paragon Refg. Co.	Toledo	2	3,000	Dubbs
Op.	Pure Oil Co.	Heath	2	3,500	Cross.

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Status:	Company	Location	Number of Units	Total daily charging capacity, barrels	Type of process
	OHIO (Cont'd)				
Op.	Pure Oil Co.	Heath	2	1,000	Gyro
SD.	Solar Refg. Co.	Lima	18	6,030	Burton
Op.	Solar Refg. Co.	Lima	2	2,000	Cross
Op.	Solar Refg. Co.	Lima	27	9,045	Burton
Op.	Standard Oil Co. of Ohio	Cleveland	4	9,600	Tube & Tank
Op.	Standard Oil Co. of Ohio	Toledo	2	5,400	Tube & Tank
Op.	Stellar Refg. Co.	Marne	1	250	Leamon
Op.	Sun Oil Co.	Toledo	2	10,000	Cross
			63	50,525	
	OKLAHOMA				
Op.	Anderson-Prichard Oil Corp.	Cyril	1	1,500	Winkler-Koch
Op.	Barnsdall Refineries, Inc.	Barnsdall	3	4,000	Cross
Op.	Barnsdall Refineries, Inc.	Okmulgee	3	3,500	Cross
Op.	Beckett Co., Inc.	Beckett	1	1,500	Jenkins
Op.	Bell Oil & Gas Co.	Grandfield	1	1,500	Dubbs
Op.	Bilmont Refg. Co.	Garber	1	1,000	Jenkins
SD.	Champlin Refg. Co.	Enid	1	2,000	Cross
Op.	Champlin Refg. Co.	Enid	1	2,000	Cross
Op.	Champlin Refg. Co.	Enid	1	2,500	Pipe still
SD.	Continental Oil Co.	Ponca City	2	7,000	Cross
Op.	Continental Oil Co.	Ponca City	6	9,000	Dubbs
Op.	Continental Oil Co.	Sapulpa	6	3,000	Cross
SD.	Eason Oil Co.	Enid	2	2,000	Jenkins
SD.	Empire Oil & Refg. Co.	Cushing	2	1,500	Doherty
Op.	Empire Oil & Refg. Co.	Okmulgee	1	1,000	Doherty
Op.	Empire Oil & Refg. Co.	Ponca City	3	2,500	Doherty
Op.	Empire Oil & Refg. Co.	Ponca City	2	2,000	Dubbs
Op.	The Globe Oil & Refg. Co.	Blackwell	1	1,000	Cross
Op.	The Globe Oil & Refg. Co.	Blackwell	1	3,000	Winkler-Koch
Bldg.	The Globe Oil & Refg. Co.	Cushing	2	4,000	Jenkins
Bldg.	Illinois Oil Co.	Cushing	1	1,500	Donnelly
Op.	Imperial Refg. Co.	Ardmore	4	2,000	Dubbs
Op.	Independent Oil & Gas Co.	Okmulgee	1	3,000	Dubbs

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Status:	Company	Location	Number of Units	Total daily charging capacity, barrels	Type of process
	OKLAHOMA (Cont'd)				
Op.	Johnson Oil Refg. Co.	Cleveland	4	3,000	Dubbs
Op.	Mid-Continent Pet. Corp.	W. Tulsa	70	12,000	Coast
SD.	Mid-Continent Pet. Corp.	W. Tulsa	10	2,000	Coast
Op.	Mid-Continent Pet. Corp.	W. Tulsa	4	4,500	Koontz
Op.	Pierce Pet. Corp.	Sand Springs	4	4,000	Cross
Op.	Producers & Refiners Corp.	W. Tulsa	6	3,500	Dubbs
Op.	Pure Oil Co.	Ardmore	4	2,000	Dubbs
Op.	Pure Oil Co.	Muskogee	2	4,000	Cross
Op.	Pure Oil Co.	Muskogee	2	1,000	Gyro
Op.	Rock Island Refg. Co.	Duncan	1	2,000	Winkler-Koch
Op.	Shaffer Oil & Refg. Co.	Cushing	5	3,800	Dubbs
Op.	The Texas Co.	W. Tulsa	9	15,000	Holmes-Manley
Bldg.	The Texas Co.	W. Tulsa	4	6,000	Pressure Coke
SD.	Texas Pacific Coal & Oil Co.	Wynnewood	2	900	Dubbs
Op.	Tidal Refg. Co.	Drumright	10	2,000	Burton
Op.	Tidal Refg. Co.	Drumright	2	3,000	Tube and Tank
Op.	Transcontinental Oil Co.	Boynton	6	900	Slagter
Op.	Transcontinental Oil Co.	Bristow	9	1,350	Slagter
Op.	White Oak Refg. Co.	Allen	1	2,000	Jenkins
Op.	H. F. Wilcox Oil & Gas Co.	Bristow	1	1,000	Dubbs
			203	135,950	
	PENNSYLVANIA				
SD.	American Oil Works Co.	Titusville	1	600	Fleming
Op.	The Atlantic Refg. Co.	Franklin	6	6,000	Cross
Op.	The Atlantic Refg. Co.	Philadelphia	10	20,000	Cross
Op.	The Atlantic Refg. Co.	Philadelphia	2	2,600	Lewis
Op.	The Atlantic Refg. Co.	Pittsburgh	2	4,000	Cross
Op.	Butler County Oil Refg. Co.	Bruin	4	2,000	Bruin
SD.	Conewango Refg. Co.	Langdale	2	500	Bruin
Op.	Emlenton Refg. Co.	Emlenton	2	200	Bruin
Op.	Freedom Oil Works Co.	Coraopolis	1	350	Dubbs
Bldg.	General Benzol Corp.	Warren	4	1,000	Ormont
Op.	Gulf Refg. Co.	Girard Point	4	8,000	Buerger
SD.	Hartol Products Corp.	Franklin	1	600	Richie
Op.	Independent Refg. Co.	Oil City	4	400	Bruin
SD.	Island Pet. Co.	Neville Island	2	300	Bruin

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Status:	Company	Location	Number of Units	Total daily charging capacity, barrels	Type of process
	PENNSYLVANIA (Cont'd)				
Op.	Kendall Refg. Co.	Bradford	2	1,300	Dubbs
Op.	Mutual Refg. Co.	Warren	2	200	Bruin
SD.	Penn. Oil Products Refg. Co.	Eldred	2	1,000	Bruin
Op.	The Pennzoil Co.	Oil City	2	2,000	Dubbs
Op.	Pure Oil Co.	Marcus Hook	4	8,000	Cross
Op.	Pure Oil Co.	Marcus Hook	3	3,000	Gyro
Op.	Sinclair Refg. Co.	Marcus Hook	20	20,000	Isom
Op.	Sun Oil Co.	Marcus Hook	7	8,000	Cross
Op.	Sun Oil Co.	Marcus Hook	4	16,000	Own
Bldg.	Sun Oil Co.	Marcus Hook	2	8,000	Own
SD.	Titusville Oil Works	Titusville	1	200	Fleming
Op.	Valvoline Oil Co.	E. Butler	3	780	Bruin
Op.	Waverly Oil Works Co.	Coraopolis	1	2,000	Cross
SD.	Waverly Oil Works Co.	Pittsburgh	1	1,000	Cross
			99	118,030	
	RHODE ISLAND				
Op.	Standard Oil Co. of N. Y.	E. Providence	3	6,000	Cross
			3	6,000	
	SOUTH CAROLINA				
Op.	Standard Oil Co. of N.J.	Charleston	4	7,500	Tube and Tar
SD.	Standard Oil Co. of N.J.	Charleston	4	6,000	Tube and Tar
			8	13,500	
	TEXAS				
Op.	American Refg. Properties	Wichita Falls	2	1,000	Cross
Op.	American Refg. Properties	Wichita Falls	1	1,700	Dubbs
Op.	Col-Tex Refg. Co.	Colorado	1	2,000	Richmond
SD.	Continental Oil Co.	Wichita Falls	4	2,000	Dubbs
Op.	Cosden Oil Co.	Big Spring	4	10,000	Jenkins
Op.	Crown Central Pet. Corp.	Houston	3	4,500	Holmes-Manle
Op.	Empire Oil & Refg. Co.	Gainesville	2	2,000	Dubbs
Op.	Grayburg Oil Co.	San Antonio	2	1,500	Dubbs
Op.	Gulf Refg. Co.	Fort Worth	6	4,200	Buerger
Bldg.	Gulf Refg. Co.	Port Arthur	14	39,500	Buerger

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Status:	Company	Location	Number of units	Total daily charging capacity, barrels	Type of process
	TEXAS (Cont'd)				
Op.	Gulf Refg. Co.	Port Arthur	67	48,000	Buerger
Op.	Gulf Refg. Co.	Sweetwater	2	4,000	Buerger
Op.	Humble Oil & Refg. Co.	Baytown	2	5,000	Cross
Op.	Humble Oil & Refg. Co.	Baytown	20	60,000	Tube and Tank
Op.	Humble Oil & Refg. Co.	Ingleside	2	6,000	Tube and Tank
Op.	Humble Oil & Refg. Co.	McCamey	2	6,000	Tube and Tank
Bldg.	Iowa Park Prod. & Refg. Co.	Iowa Park	1	1,200	Jenkins
Op.	LaSalle Pet. Corp.	Burkburnett	1	2,000	Jenkins
Op.	agnolia Pet. Co.	Beaumont	48	6,500	Burton
Op.	Magnolia Pet. Co.	Beaumont	20	52,000	Cross
Op.	Magnolia Pet. Co.	Fort Worth	1	2,000	Cross
Op.	Motor Fuel Products Co.	Laredo	1	1,500	Jenkins
Bldg.	Orient Pet. Co.	Wichita Falls	1	2,000	Jenkins
Op.	Panhandle Refg. Co.	Wichita Falls	2	1,500	Dubbs
Bldg.	Pasotex Pet. Co.	El Paso	1	4,000	Richmond
Op.	Pecos Refg. Co.	Pecos	1	2,500	Jenkins
SD.	Pecos Refg. Co.	Pecos	1	2,500	Jenkins
SD.	Petroleum Conversion Corp.	Texas City	1	500	True Vapor Phase
Op.	Pure Oil Co.	Nederland	26	16,000	Cross
Op.	Pure Oil Co.	Nederland	3	3,000	Gyro
Op.	Richardson Refg. Co.	Big Spring	2	5,000	Jenkins
Op.	Shell Pet. Corp.	Deer Creek	2	3,000	Dubbs
Bldg.	Shell Pet. Corp.	Deer Creek	4	7,000	Dubbs
Op.	Simms Oil Co.	W. Dallas	2	2,170	Cross
Op.	Sinclair Refg. Co.	Sinco	20	20,000	Isom
Op.	Star Refg. & Producing Co.	Fort Worth	1	300	Fleming
Op.	J.J.&M. Taxman Refg. Co.	Wichita Falls	1	1,250	Pipe still
SD.	Terminal Oil & Refg. Co.	Texas City	1	1,800	Jenkins
Op.	The Texas Co.	Amarillo	1	1,500	Pressure Coke
Op.	The Texas Co.	El Paso	1	1,500	Holmes-Manley
Op.	The Texas Co.	W. Dallas	2	3,600	Holmes-Manley
Bldg.	The Texas Co.	W. Dallas	3	4,500	Pressure Coke
Op.	The Texas Co.	Houston	1	1,000	Tube and Tank
Bldg.	The Texas Co.	Port Arthur	1	3,000	Vapor Phase
Bldg.	The Texas Co.	Port Arthur	2	3,000	Pressure Coke
Op.	The Texas Co.	Port Arthur	52	80,000	Holmes-Manley
Op.	The Texas Co.	San Antonio	2	3,000	Holmes-Manley
Op.	Texas Pacific Coal & Oil Co.	Fort Worth	1	800	Cross
Op.	Transcontinental Oil Co.	Fort Worth	9	1,350	Slagter
Op.	White Eagle Oil Corp.	Fort Worth	1	2,000	Holmes-Manley
			351	440,370	

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Status:	Company	Location	Number of Units	Total daily charging capacity, barrels	Type of process
	UTAH				
SD.	Utah Oil Refg. Co.	N. Salt Lake City	30	3,800	Burton
Op.	Utah Oil Refg. Co.	N. Salt Lake City	2	6,400	Holmes-Manley
			32	10,200	
	WEST VIRGINIA				
Op.	Ohio Valley Refg.Co.	St. Marys	3	300	Bruin
Op.	Pure Oil Co.	Cabin Creek Jct.	3	1,200	Gyro
Op.	Standard Oil Co. of N.J.	Parkersburg	2	3,500	Tube and Tank
Op.	Tri-State Refg. Co.	Kenova	1	1,800	Jenkins
			9	6,800	
	WYOMING				
SD.	Continental Oil Co.	Glenrock	16	3,000	Burton
SD.	Egaso Operating Co.	Osage	1	1,000	Cross
SD.	Midwest Refg. Co.	Casper	40	6,200	Burton
Op.	Midwest Refg. Co.	Greybull	40	4,680	Burton
Op.	Midwest Refg. Co.	Laramie	15	2,325	Burton
SD.	Midwest Refg. Co.	Laramie	5	775	Burton
Op.	Producers & Refiners Corp.	Parco	6	3,600	Dubbs
Op.	Standard Oil Co.(Ind.)	Casper	50	17,850	Burton
SD.	Standard Oil Co.(Ind.)	Casper	197	30,035	Burton
Op.	The Texas Co.	Casper	5	7,900	Holmes-Manley
Bldg.	The Texas Co.	Casper	1	1,500	Pressure Coke
Op.	The Texas Co.	Cody	1	1,500	Holmes-Manley
Op.	White Eagle Oil Corp.	Casper	1	1,500	Holmes-Manley
Op.	White Eagle Oil Corp.	Casper	1	1,000	Jenkins
Op.	White Eagle Oil Corp.	Casper	1	2,000	White Eagle
			380	84,865	

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